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**BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

Application Number: 10/629,415
Filing Date: July 29, 2003
Appellant(s): BURKEY, TODD R.

James C. Evans
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed 11/24/2010 appealing from the Office action mailed 5/21/2010.

**(1) Real Party in Interest**

The examiner has no comment on the statement, or lack of statement, identifying by name the real party in interest in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The following is a list of claims that are rejected and pending in the application:

1-5, 7, 9, 10, 13 and 16-24

**(4) Status of Amendments After Final**

The examiner has no comment on the appellant's statement of the status of amendments after final rejection contained in the brief.

**(5) Summary of Claimed Subject Matter**

The examiner has no comment on the summary of claimed subject matter contained in the brief.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The examiner has no comment on the appellant's statement of the grounds of rejection to be reviewed on appeal. Every ground of rejection set forth in the Office action from which the appeal is taken (as modified by any advisory actions) is being maintained by the examiner except for the grounds of rejection (if any) listed under the subheading "WITHDRAWN REJECTIONS." New grounds of rejection (if any) are provided under the subheading "NEW GROUNDS OF REJECTION."

**(7) Claims Appendix**

The examiner has no comment on the copy of the appealed claims contained in the Appendix to the appellant's brief.

**(8) Evidence Relied Upon**

The following is a listing of the evidence (e.g., patents, publications, Official Notice, and admitted prior art) relied upon in the rejection of claims under appeal.

| | | |
|---|---|---|
| **6,880,052** | **Lubbers et al.** | **4-2005** |
| **6,530,035** | **Bridge** | **3-2003** |
| **6629202** | **Cabrera et al.** | **9-2003** |
| **6,275,898** | **DeKoning** | **8-2001** |

**(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

**Claim Rejections - 35 USC § 103**

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

**Claim 1-2, 9 and 19-24** are rejected under 35 U.S.C. 103(a) as being unpatentable over Lubbers et al. (US 6,880,052) in view of Bridge (US 6,530,035).

As per **claim 1**, Lubbers discloses A program storage device readable by a computer embodying in a tangible medium one or more programs of instructions executable by the computer to perform a method for dynamically expanding mirrored virtual disks in a virtual disk storage system, the method comprising: **[increasing the size of virtual disks or logical units (LUNs) in an automated fashion in a copy set or replication environment having source**

**and destination LUNs wherein each LUN has a RAID 0-5 data protection (col. 4, lines 44-67; col. 5, lines 59-62)]**

receiving by a source virtual disk a request to dynamically expand the mirrored virtual disks which include the source virtual disk and at least one destination virtual disk; **[host provides capacity requirements to storage controllers 105 and source LUNs are configured for host access wherein LUNs may be resized according to host requirement (col. 5, line 27-col. 6, line 5) the size of LUNs can be increased/resized in an automated fashion wherein the increase is automatically propagated to other members of a copy set (col. 4, lines 44-67)]** associating additional storage with the mirrored virtual disks; **[size of LUNs increased by allocating more storage from physical devices (col. 5, line 51-col. 6, line 37; col. 8, lines 5-9)]** increasing respective sizes of each of the at least one destination virtual disk **[Lubbers discloses "a copy set" is a set of member virtual disks where each member virtual disk is a replica of the others" (col. 8, line 57-col. 9, line 8) wherein a LUN may be resized and the resizing is automatically propagated to other members of the copy set (col. 4, lines 44-67; col. 6, lines 5-37)]** but does not expressly disclose these changes are implemented before reporting a new storage size of the source virtual disk; and reporting the new size of the source virtual disk

To further detail Lubbers, Bridge discloses receiving a request to resize a virtual disk, associating additional storage with the virtual disk and reporting the new sizes users and more specifically, resizing or changes the size of a logical unit are implemented before reporting a new storage size of the source virtual disk (or logical unit); and reporting the new size of the source virtual disk (or logical unit) **[expanding or shrinking logical volumes by adding or removing extents wherein when the logical volume is configured to a new size, the new size is**

**reported in logical volume directory; thus allowing I/O operations are allowed on the logical volume (col. 16, line 32- col. 17, line 4; col. 20, lines 1-33) wherein the added or removed extents may be mirrored (col. 17, line 5-col. 18, line 58)].**

Lubbers and Bridge are analogous art because they are from the same field of endeavor of computer memory access and control.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to modify the system of Lubbers which provides source and destination virtual disks in a copy set and resizes these virtual disks in an automatic fashion wherein any changes to a source virtual disk are propagated to the destination virtual disk and further explicitly expand the size or perform changes of size of the copy set of source and destination virtual disks of Lubbers and later reporting the size of the copy set or source and destination virtual disks in the same manner that Bridge first resizes a logical unit and later reports the changes to the logical unit by updating directory tables in order to allow I/O access to the virtual disks, since Bridge discloses this provides the advantage of dynamically accommodating to system requirement changes in a mirrored system configuration (col. 3, line 45-col. 4, line 59; fig. 9 and related text).

Therefore, it would have been obvious to combine Lubbers with Bride for the benefit of creating a system/method of resizing virtual disks to obtain the invention as specified in claim 1.

As per claim 2 The program storage device of claim 1 wherein the request step of associating additional storage further comprises: creating an amount of storage by providing RAIDs on each subsystem that is associated with each component of a mirror set; assigning the RAIDs to a specific virtual disk for a mirror device; and **[Lubbers discloses each LUN has a**

**specified data protection RAID 0-5 level wherein the data protection level of source and destination may vary (col. 5, line 51-col. 6, line 5; col. 6, lines 16-37)]**
specifying a size for the virtual disk and mapping the size of the virtual disk directly to all components of the mirror set **[Lubbers discloses the LUNs in a copy set are mirror and are mapped to physical disks and each LUN has a specified RAID 0-5 level (col. 5, line 51-col. 6, line 37)]**.

As per claim 9 . (previously presented) The apparatus of claim 23, wherein creating an amount of necessary storage includes providing RAIDs on each subsystem that is associated with each component of a mirror set, attaching the RAIDs to a specific virtual disk for a mirror device and specifying a size for the virtual disk and mapping the size of the virtual disk directly to all components of the mirror set **[The rationale in the rejection to claim 2 is herein incorporated]**.

As per claim 19 The program storage device of claim 1, wherein a first of the mirrored virtual disks has a different virtualization configuration from a second of the mirrored virtual disks **[Lubbers discloses source virtual disk and destination virtual disk may each implement different data protection configurations (col. 7, line 64-col. 8, line 29; col. 5, line 51-col. 6, line 37)]**.

As per claim 20 A method, comprising: receiving a request to dynamically resize mirrored virtual disks, the mirrored virtual disks comprising a source virtual disk and a set of

destination virtual disks that includes at least one destination virtual disk; associating additional storage with the mirrored virtual disks; reporting respective new storage sizes of each destination virtual disk before reporting a new storage size of the source virtual disk; and reporting the new storage size of the source virtual disk **[The rationale in the rejection to claim 1 is herein incorporated]**.

As per claim 21. The method of claim 20, wherein the request is received by the source virtual disk **[Lubbers discloses host provides capacity requirements to storage controllers 105 and source LUNs are configured for host access wherein LUNs may be resized according to host requirement (col. 5, line 27-col. 6, line 5) wherein host writes to source LUNs (figs. 4-6 and related text)]**.

As per claim 22 The method of claim 21, wherein, in the step of receiving, the request is received electronically from a host and, in the step of reporting the new storage size of the source virtual disk, the new storage size of the source virtual disk is reported to the host **[Lubbers discloses the size of source virtual disk becomes available for host writes, thus it is reported to host (col. 5, line 26- col. 6, line 5; col. 12, lines 38-51)]**. Bridge discloses **[expanding or shrinking logical volumes by adding or removing extents wherein when the logical volume is configured to a new size, the new size is reported in logical volume directory; thus allowing I/O operations are allowed on the logical volume (col. 16, line 32- col. 17, line 4; col. 20, lines 1-33) wherein the added or removed extents may be mirrored (col. 17, line 5- col. 18, line 58)]**.

As per claim 23, Lubbers discloses An apparatus, comprising:

a set of mirrored virtual disks, including a source virtual disk and at least one destination virtual disk, the at least one destination virtual disk mirroring the source virtual disk, wherein the source and destination virtual disks have the same size; **[source and destination virtual disks (fig. 4 and related text; col. 7, line 64-col. 8, line 29)]**

a management module that includes a host side interface adapted to [interpreted as intended use, See MPEP 2106 II-C] communicating with host devices, through which the management module is adapted by logic to [interpreted as intended use, See MPEP 2106 II-C] report the size of the mirrored virtual disks and to receive a request to expand the mirrored virtual disks, and

a storage system interface for [interpreted as intended use, See MPEP 2106 II-C] communicating with the virtual disks that is adapted to [interpreted as intended use, See MPEP 2106 II-C] requesting the source virtual disk to expand and to [interpreted as intended use, See MPEP 2106 II-C] obtain reports of the size of the virtual disks from the source virtual disk; and logic adapted to [interpreted as intended use, See MPEP 2106 II-C] provide reports of the size of the source virtual disk to the management module through the storage system interface, **[capacity requirements to storage controllers 105 and source LUNs are configured for host access wherein LUNs may be resized according to host capacity requirements (col. 5, line 27-col. 6, line 5; col. 4, lines 44-67) the size/capacity of source virtual disk is available for host accesses and is thus reported (col. 7, line 64-col. 8, line 29)]**

satisfy an expansion request by creating an amount of necessary storage before changing the size that will be obtained by the management module in reports from the source virtual disk; and

change the size that will be obtained by the management module in reports from the source virtual but does not disclose expressly these changes are implemented before reporting a new storage size of the source virtual disk; and reporting the new size of the source virtual disk

To further detail Lubbers, Bridge discloses receiving a request to resize a virtual disk, associating additional storage with the virtual disk and reporting the new sizes users and more specifically, resizing or changes the size of a logical unit are implemented before reporting a new storage size of the source virtual disk (or logical unit); and reporting the new size of the source virtual disk (or logical unit) **[expanding or shrinking logical volumes by adding or removing extents wherein when the logical volume is configured to a new size, the new size is reported in logical volume directory; thus allowing I/O operations are allowed on the logical volume (col. 16, line 32- col. 17, line 4; col. 20, lines 1-33) wherein the added or removed extents may be mirrored (col. 17, line 5-col. 18, line 58)]**.

Lubbers and Bridge are analogous art because they are from the same field of endeavor of computer memory access and control.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to modify the system of Lubbers which provides source and destination virtual disks in a copy set and resizes these virtual disks in an automatic fashion wherein any changes to a source virtual disk are propagated to the destination virtual disk and further explicitly expand the size or perform changes of size of the copy set of source and destination virtual disks of Lubbers and later reporting the size of the copy set or source and destination virtual disks in the same manner that Bridge first resizes a logical unit and later reports the changes to the logical unit by updating directory tables in order to allow I/O access to the virtual disks, since Bridge discloses this

provides the advantage of dynamically accommodating to system requirement changes in a mirrored system configuration (col. 3, line 45-col. 4, line 59; fig. 9 and related text).

Therefore, it would have been obvious to combine Lubbers with Bride for the benefit of creating a system/method of resizing virtual disks to obtain the invention as specified in claim 23.

As per claim 24 The apparatus of claim 23, further comprising: a host device adapted to send a request to the management module to expand the mirrored virtual disks **[Lubbers discloses the capacity requirements are sent from host storage device to controllers 105 and source and destination virtual disks are resized accordingly (col. 4, lines 44-67; col. 5, line 27-col. 6, line 5)]**.

**Claims 3 and 17-18** are rejected under 35 U.S.C. 103(a) as being unpatentable over Lubbers et al. (US 6,880,052) in view of Bridge (US 6,530,035) as applied to claim 1 above, and further in view of Cabrera et al. (US 6,629,202).

As per claim 3, the combination of Lubbers and Bridge disclsoes The program storage device of claim 2, but does not disclose expressly wherein the specifying a size for the virtual disk and mapping the size of the virtual disk is performed by an operating system.

Cabrera discloses specifying a size for the virtual disk and mapping the size of the virtual disk is performed by an operating system as **[logical volumes are mapped and resized under**

**the control of the operating system (col. 8, lines 59-67; col. 10, lines 4-17; col. 11, line 50-col. 12, line 33)**].

Lubbers, Bridge and Cabrera are analogous art because they are from the same field of endeavor of computer memory access and control.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to modify the combined system of Lubbers and Bridge to have the operating system perform the specifying a size for the virtual disk and mapping the size of the virtual disk as taught by Cabrera, since Cabrera discloses this would provide dynamic volume resizing without system disruption.

Therefore, it would have been obvious to combine Lubbers with Bridge and Cabrera for the benefit of creating a system/method to obtain the invention as specified in claim 3.

As per claim 17 The program storage device of claim 1, further comprising: providing by the source virtual disk continuous availability for normal disk access operations between the step of receiving a request and the step of reporting the new size of the source virtual disk [**Lubbers discloses the host can continuously write to source (col. 12, line 38-col. 13, line 15)**]; but Lubbers is not explicitly that this continuous access occurs during resizing. However, Cabrera discloses [**logical volumes and their plex are dynamically mapped and resized under the control of the operating system without system disruption (col. 8, lines 59-67; col. 10, lines 4-17; col. 11, line 50-col. 12, line 33)**].

Lubbers, Bridge and Cabrera are analogous art because they are from the same field of endeavor of computer memory access and control.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to modify the combined system of Lubbers and Bridge to have logical volumes and their plex are dynamically mapped and resized under the control of the operating system without system disruption as taught by Cabrera discloses since this would provide faster and continuous access while configuring/reconfiguring logical volumes.

Therefore, it would have been obvious to combine Lubbers with Bridge and Cabrera for the benefit of creating a system/method to obtain the invention as specified in claim 17.

As per claim 18 The program storage device of claim 17, the method further comprising: providing by the at least one destination virtual disk continuous mirroring of the source virtual disk between the step of receiving a request and the step of reporting the new storage size of the source virtual disk **[Lubbers discloses each time data is written to source, a copy operation is scheduled to destination, wherein these copy operations can be scheduled as needed and explains ongoing operations of copying data from the source to the destination can be performed (col. 12, line 57-col. 13, line 15). Cabrera further discloses data is continuously mirrored by first plex component (col. 11, line 50-col. 12, line 33)]**.

**Claims 4, 7, 10, 13 and 16** are rejected under 35 U.S.C. 103(a) as being unpatentable over Lubbers et al. (US 6,880,052) in view of Bridge (US 6,530,035) and DeKoning (US 6,275,898).

As per claim 4. (currently amended) Lubbers discloses A program storage device readable by a computer embodying in a tangible medium one or more programs of instructions

executable by the computer to perform a method for dynamically resizing mirrored virtual disks in a RAID storage system, the method comprising: **[resizing virtual disks or logical units (LUNs) in an automated fashion in a copy set or replication environment having source and destination LUNs wherein each LUN has a RAID 0-5 data protection (col. 4, lines 44-67; col. 5, lines 59-62)]**

receiving a request to dynamically shrink mirrored virtual disks in the RAID storage system, which include the source virtual disk and at least one destination virtual disk; and resizing the at least one destination virtual disk **[Lubbers discloses resizing members of a copy set dynamically wherein any change made to one LUN member of a copy set is automatically propagated to the other members (col. 4, lines 44-67; col. 6, lines 5-37); wherein Applicant should note that the ability to resize inherently includes the ability of shrinking (such as shrinking taught by Bridge and DeKoning in the following discussion) the size of any of the members of the copy set]**

changing the reported size of the virtual disks and making the virtual disks available for operation; **[Lubbers discloses resizing virtual disks or logical units (LUNs) in an automated fashion in a copy set or replication environment having source and destination LUNs wherein each LUN has a RAID 0-5 data protection (col. 4, lines 44-67; col. 5, lines 59-62), and explains "hosts... access physical storage capacity by addressing read and write operations to specified LUNs... storage controller... manage the tasks of allocating... resizing LUNs, and other functions that maintain integrity and availability of the data" (col. 5, line 51-col. 6, line 5); thus, the reported size of the virtual disks is changed an the disks are available to hosts as LUNs]**.

Lubbers does not expressly disclose after making the virtual disks available for operation, manipulating RAIDS in the RAID storage system assigned to the mirrored virtual disks prior to resizing the mirrored virtual disks, wherein the step of manipulating further comprises specifying a size of a virtual disk and mapping the size of the virtual disk directly to all components of a mirror set, detaching any RAIDs that extend beyond the specified size of the virtual disk, and truncating RAIDs to free up any excess physical segments back into the RAID storage system.

Bridge discloses changing the reported size of the virtual disks and making the virtual disk available for operation; as **[shrinking logical volumes by removing extents and updating directory (col. 20, lines 1-33)]** and after making the virtual disks available for operation, manipulating physical storage in order to resize the virtual disks by deallocating necessary storage in order to reach the desired shrunk size **[wherein when the logical volume shrunk, the size of the logical volume is first updated in the volume directory (thus made available), then each extent set is deallocated until the logical volume has shrunk to the correct size (col. 20, lines 1-33; also refer to expanding in col. 16, line 32- col. 17, line 4) wherein the added or removed extents may be mirrored (col. 17, line 5-col. 18, line 58)]**.

Lubbers and Bridge are analogous art because they are from the same field of endeavor of computer memory access and control.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to modify the system of Lubbers which provides source and destination virtual disks in a copy set and resizes these virtual disks in an automatic fashion wherein any changes to a source virtual disk are propagated to the destination virtual disk and further explicitly perform changes of size of the copy set of source and destination virtual disks of Lubbers and discloses changing

the reported size of the virtual disks and making the virtual disk available for operation; and after making the virtual disks available for operation, manipulating physical storage in order to resize the virtual disks by deallocating necessary storage in order to reach the desired shrunk size as taught by Bridge, since Bridge discloses doing so would provide the advantage of dynamically accommodating to system requirement changes in a mirrored system configuration (col. 3, line 45-col. 4, line 59; fig. 9 and related text); however, the combination of Lubbers and Bridge does not expressly disclose manipulating RAIDS in the RAID storage system assigned to the mirrored virtual disks prior to resizing the mirrored virtual disks, wherein the step of manipulating further comprises specifying a size of a virtual disk and mapping the size of the virtual disk directly to all components of a mirror set, detaching any RAIDs that extend beyond the specified size of the virtual disk, and truncating RAIDs to free up any excess physical segments back into the RAID storage system.

DeKoning discloses manipulating RAIDS in the RAID storage system assigned to the mirrored virtual disks prior to resizing the mirrored virtual disks, wherein the step of manipulating further comprises specifying a size of a virtual disk and mapping the size of the virtual disk directly to all components of a mirror set, detaching any RAIDs that extend beyond the specified size of the virtual disk, and truncating RAIDs to free up any excess physical segments back into the RAID storage system; as **[a LUN may be broken up into a plurality of partitions wherein "each partition retains its own configuration and mapping information. Each partition is therefore managed essentially as though a separate RAID LUN" (col. 4, lines 23-26) wherein each partition may grow or shrink in accordance to its capacity requirements (col. 7, lines 46-48) wherein when a partition is to shrink or be demoted, its**

**RAID level configuration is manipulated to change from a RAID level requiring more space to one requiring less space (col. 7, lines 10-48) and any RAIDs or unused RAID space is detached and pooled in an unused space pool (col. 7, lines 29-48) and RAIDs are truncated so that the available partition space is changed from 20 MB in size to for example, 10 MB (col. 10, line 25-col. 11, lines 7) thus the unused space is freed up into the RAID system to the pool of unused space (col. 7, lines 29-48; col. 11, lines 3-7)**].

Lubbers, Bridge and DeKoning are analogous art because they are from the same field of endeavor of computer memory access and control.

At the time of the invention, it would have been obvious to one having ordinary skill in the art to modify the combined system/method of Lubbers and Bridge wherein mirrored virtual disks are resized and any changes to one member of a copy set consisting of a source and destination LUNs are automatically propagated to the other member to further perform said resizing in a manner such as that taught by DeKoning wherein RAIDs are manipulated prior to resizing a LUN and RAIDs are detached and truncated to free up space in the LUN since DeKoning discloses such approach would ensure **[provision of simpler techniques in manipulation of a LUNs and simplified dynamic adjustment of configuration of a RAID storage system to adapt to desired performance and utilization goals (col. 3, lines 52-55; col. 4, lines 57-61)**].

Therefore, it would have been obvious to combine Lubbers with Bride for the benefit of creating a system/method of resizing virtual disks to obtain the invention as specified in claim 4.

As per claim 7. (previously presented) A program storage device readable by a computer embodying in a tangible medium one or more programs of instructions executable by the computer to perform a method for dynamically shrinking mirrored virtual disks in a RAID storage system, the method comprising: specifying a size of a virtual disk and mapping the size of the virtual disk directly to all components of a mirror set; detaching any RAIDs that extend beyond the specified size of the virtual disk; and truncating RAIDs to free up any excess physical segments back into the RAID storage system **[The rationale in the rejection to claim 4 is herein incorporated]**.

As per claim 10. (previously presented) An apparatus for dynamically resizing mirrored virtual disks in a RAID storage system, comprising: a storage system interface for providing access to a storage system; host side interface for communicating with host devices; and a processor, coupled to the host side interface and the storage system interface, the processor being configured for receiving a request to resize mirrored virtual disks in a RAID storage system to a new size, changing reported size of the mirrored virtual disks to the new size, providing resized mirrored virtual disks for operaion, manipulating RAIDs in the RAID storage system assigned to the mirrored virtual disks prior to resizing the mirrored virtual disks, mapping the size of the virtual disk directly to all components of a mirror set, detaching any RAIDs that extend beyond the specified size of the virtual disk, and truncating RAIDs to free up any excess physical segments back into the RAID storage system, **[The rationale in the rejection to claim 4 is herein incorporated]**; further requiring:

a storage system interface for {interpreted as intended use, see MPEP 2106 II-C} providing access to a storage system; host side interface for {interpreted as intended use, see MPEP 2106 II-C}communicating with host devices; **[Lubbers discloses storage controllers 105 virtualize physical storage into logical units LUNs and hosts 102 access storage by addressing LUNs (col. 5, lines 51-67; fig. 1 and related text) via for example, FC switch (301) (fig. 3 and related text)]** and a processor, coupled to the host side interface and the storage system interface, the processor being configured for {interpreted as intended use, see MPEP 2106 II-C}receiving a request to dynamically resize mirrored virtual disks in a RAID storage system **[Lubbers discloses storage controllers 105 virtualize each LUN, including resizing of LUNs (col. 5, line 51-col. 6, line 37) and are coupled to hosts 102 computers (col. 5, lines 27-62)]**.

As per claim 13. (previously presented) A storage area network, comprising: a plurality of hosts; at least one access device, coupled to the plurality of hosts, for managing data input/output operations; and a storage platform, for providing networked storage to the at least one access device, the storage platform including a management device for dynamically resizing mirrored virtual disks in a RAID storage system, the management device further comprising: a storage system interface for providing access to a storage system; host side interface for communicating with host devices; and a processor, coupled to the host side interface and the storage system interface, the processor being configured for receiving a request to resize mirrored virtual disks in a RAID storage system to a new size, changing reported size of the mirrored virtual disks to the new size, providing resized virtual disks for operation, manipulating RAIDs in the RAID storage system assigned to the mirrored virtual disks mapping the size of the

virtual disk directly to all components of a mirror set, detaching any RAIDs that extend beyond the specified size of the virtual disk and truncating RAIDs to free up any excess physical segments back into the RAID storage system **[The rationale in the rejection to claim 4 is herein incorporated]**; further requiring:

A storage area network, comprising: **[Lubbers discloses storage area network (SAN) (fig. 1 and related text)]** a plurality of hosts; **[hosts 102 (fig. 1 and related text)]** at least one access device, coupled to the plurality of hosts, for managing data input/output operations; **[host computers which may be any kind of computer or processor performing input/output of data from storage devices on SAN (col. 5, lines 27-50)]** and a storage platform, for providing networked storage to the at least one access device, the storage platform including a management device for dynamically resizing mirrored virtual disks in a RAID storage system, the management device further comprising: a storage system interface for providing access to a storage system; **[Lubbers discloses SAN including physical storage virtualized by controllers 105 into logical units LUNs, which also resize LUNs (col. 5, line 51-col. 6, lines 37)]** host side interface for communicating with host devices; **[Lubbers discloses storage controllers 105 virtualize physical storage into logical units LUNs and hosts 102 access storage by addressing LUNs (col. 5, lines 51-67; fig. 1 and related text) via for example, FC switch (301) (fig. 3 and related text)]** and a processor, coupled to the host side interface and the storage system interface, the processor being configured for receiving a request to dynamically resize mirrored virtual disks in a RAID storage system **[Lubbers discloses storage controllers 105 virtualize each LUN, including resizing of LUNs (col. 5, line 51-col. 6, line 37) and are coupled to hosts 102 computers (col. 5, lines 27-62)]**.

As per claim 16. (previously presented) An apparatus for dynamically resizing mirrored virtual disks in a RAID storage system, comprising: first means for providing an interface to a storage system; second means for providing communication with host devices; and means, coupled to the host side interface and the storage system interface, for receiving a request to dynamically resize mirrored virtual disks in a RAID storage system, manipulating RAIDs in the RAID storage system assigned to the mirrored virtual disks, wherein the means for manipulating further comprises means for specifying a size of a virtual disk and mapping the size of the virtual disk directly to all components of a mirror set, detaching any RAIDs that extend beyond the specified size of the virtual disk and truncating RAIDs to free up any excess physical segments back into the RAID storage system, and before the step of manipulating RAIDs, resizing the mirrored virtual disks, and providing the resized mirrored virtual disks for operation **[The rationale in the rejection to claims 4, 7 and 13 is herein incorporated]**.

**Claim 5** is rejected under 35 U.S.C. 103(a) as being unpatentable over Lubbers et al. (US 6,880,052) in view of Bridge (US 6,530,035) and DeKoning (US 6,275,898) as applied to claim 5 above, and further in view of Cabrera et al. (US 6,629,202).

As per claim 5. (original) The combination of Lubbers, Bridge and DeKoning discloses The program storage device of claim 4 but does not expressly disclose wherein the specifying a size for the virtual disk and mapping the size of the virtual disk is performed by an operating system.

Cabrera discloses specifying a size for the virtual disk and mapping the size of the virtual disk is performed by an operating system as **[logical volumes are mapped and resized under the control of the operating system (col. 8, lines 59-67; col. 10, lines 4-17; col. 11, line 50-col. 12, line 33)]**.

Lubbers, Bridge, DeKoning and Cabrera are analogous art because they are from the same field of endeavor of computer memory access and control.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to modify the combined system of Lubbers, Bridge and DeKoning to have the operating system perform the specifying a size for the virtual disk and mapping the size of the virtual disk as taught by Cabrera, since Cabrera discloses this would provide dynamic volume resizing without system disruption.

Therefore, it would have been obvious to combine Lubbers with Bridge, DeKoning and Cabrera for the benefit of creating a system/method to obtain the invention as specified in claim 5.

**(10) Response to Argument**

**A. 103(a): Obviousness over Lubbers in view of Bridge (Claims 1, 2, 9 and 19-24)**

**1. Claim 1**

Appellant argues "Applicant's dynamical expansion approach, which relies on appropriate ordering of operations, does not require quiescing to maintain synchronization (i.e., ongoing mirroring) of the information on the source and destination disks through and beyond the expansion" (pages 15 and 17)... "quiescing is the approach likely followed by Lubbers"

(page 17); and regarding Examiner's remark in the office action mailed on 5/21/2010, stating that the pending claims do not recite "resizing propagated synchronously to second virtual disk", Appellant argues "It is not necessary to include in a claim the expected advantages of the combination of elements and limitations presented there... The applicant is then free to explain in the specification, or in remarks, why the structure is advantageous over prior art, which is relevant to obviousness" (pages 17-18).

In response, these arguments/remarks have been fully considered but they are not deemed persuasive since they are directed to limitations that are not being claimed and while these limitations may represent advantages related to Appellant's invention which may be stated in Appellant's Specification and arguments, limitations that are not recited in the claims are not read into the claims for purposes of examination.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., that Appellant's invention does not require quiescing to maintain synchronization) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See In re Van Geuns, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Appellant argues "none of the cited sections of Bridge deal with the missing requirement, explicit in Applicant's claim, of resizing the destination virtual disks before reporting a new size of the source virtual disk" as "like Lubbers, Bridge does not teach the correct ordering of operations when expanding a mirrored set of virtual disks. The first section of text cited above...

deals with expanding a single logical volume, not a mirroring pair or set. The second cited section... relates to shrinking, so it is irrelevant to this claim. The third section... pertains to allocating a new mirrored extent set".

In response, these arguments/remarks have been fully considered but they are not deemed persuasive.

In view of the following discussion, Examiner would like to emphasize the following:

Sources of rationale supporting a rejection under 35 U.S.C. 103 may be in a reference, or reasoned from common knowledge in the art, scientific principles, art recognized equivalents, or legal precedent. The CCPA has held that "in considering the disclosure of a reference, it is proper to take into account not only specific teachings of the reference but also the inferences which one skilled in the art would reasonably be expected to draw therefrom." In re Preda, 401 F.2d 825, 826, 159 USPQ 342, 344 (CCPA 1968); MPEP 2144.01.

In determining obviousness under 35 U.S.C. 103 in view of the Supreme Court decision in KSR International Co. v. Teleflex Inc., the Supreme Court stated that: "If a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill".

Still further, the Court states that "the focus when making a determination of obviousness should be on what a person of ordinary skill in the pertinent art would have known at the time of the invention…and this is regardless of whether the source of that knowledge and ability was documentary prior art, general knowledge in the art, or common sense".

Appellant should note that the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See In re Keller, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

Appellant's arguments stating that Bridge's disclosure does not apply to the pending claims because Bridge deals with expanding a logical volume and not a mirrored set are not deemed persuasive since the Examiner respectfully submits that Bridge's disclosure has been relied upon for teaching and suggesting when to report the new size when expanding storage capacity. Appellant should note that a RAID comprises a mere logical volume which is configured as a mirrored configuration; thus Bridges's teachings regarding when to report the sizes of expanded logical volumes, which, according to Bridge may be mirrored, are deemed to make obvious modifications regarding when to report the sizes of the copy sets taught by Lubbers. More specifically, from Bridge's disclosure which teaches expanding a logical volume **[(col. 16, line 32-col. 17, line 5)]** which may be mirrored **[Bridge clearly teaches "either mirroring or parity protection can be used to allocate the extents" (col. 16, lines 65-66)]** and later reporting the logical volume's new size, one of ordinary skill in the art would conclude that it would be obvious to modify the system/method taught by Lubbers where a copy set is expanded to first expand the copy set (which comprises a mere logical volume configured as a mirrored set), and later report its size (which includes the size of the source volume) as taught by Bridge since Bridge suggests doing so would provide the advantages of dynamically

accommodating to system requirement changes in a mirrored system configuration (col. 3, line 45-col. 4, line 59; fig. 9 and related text).

Further, Bridge explicitly teaches **["the process for expanding a logical volume is very similar to the process for allocating space when creating a logical volume" (col. 16, line 32-col. 17, line 4)]**, wherein when discussing the process of creating a logical volume which is configured as a mirrored configuration, Bridge discloses **["once all primary and secondary extents have been allocated, update pointer in either the logical volume directory or in pointer extents to point to the next extents... The appropriate allocation tables should also be updated to reflect the allocations" (col. 17, lines 48-52)]**; thus, clearly teaching expanding or allocating new capacity to mirrored extents and later reporting the new sizes in allocation tables, as required by claim 1.

In view of the above, the combination of Lubbers and Bridge discloses resizing the destination virtual disks before reporting a new size of the source virtual disk as required by pending claim 1 as Lubbers clearly teaches resizing of a copy set or pair of virtual disks **[Lubbers discloses "a copy set" is a set of member virtual disks where each member virtual disk is a replica of the others" (col. 8, line 57-col. 9, line 8) wherein a LUN may be resized and the resizing is automatically propagated to other members of the copy set (col. 4, lines 44-67; col. 6, lines 5-37)]**, but does not expressly disclose when the new sizes are reported. Thus, the problem to be solved is to determine when to report the new sizes of an already resized pair of mirror disks. Regarding this limitation, Bridge discloses **[expanding logical volumes by adding extents wherein when the logical volume is configured to a new size, the new size is later reported in logical volume directory; thus allowing I/O operations on the logical**

**volume, refer to steps 3 and 4 and explains "the process for expanding a logical volume is very similar to the process for allocating space when creating a logical volume" (col. 16, line 32- col. 17, line 4) wherein the added or removed extents may be mirrored (col. 17, line 5-col. 18, line 58) and when a mirrored configuration is used, Bridge discloses step 1, wherein a primary extent is allocated; step 2, where extents are allocated on the destination, secondary or mirror disk; and later, in step 4, Bridge discloses, "once all primary and secondary extents have been allocated, update pointers in either the logical volume directory or in pointer extents to point to new extents... The appropriate allocation tables should also be updated to reflect the allocations" (col. 17, lines 22-52)**]; thus, providing a solution and suggestion as to when to report the new size of logical volumes, including logical volume pairs of mirrors, which are first modified, and later, their directory is updated or reported to allow I/O operations to the newly expanded or modified area.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to modify the system of Lubbers which provides source and destination virtual disks in a copy set and resizes these virtual disks in an automatic fashion wherein any changes to a source virtual disk are propagated to the destination virtual disk and further explicitly expand the size or perform changes of size of the copy set of source and destination virtual disks of Lubbers and later reporting the size of the copy set or source and destination virtual disks in the same manner that Bridge first resizes a logical unit (including a mirrored configuration, wherein mirror partners are first modified and later the directory is updated), and later reports the changes to the logical unit by updating directory tables in order to allow I/O access to the virtual disks, since Bridge discloses this provides the advantage of dynamically accommodating to system

requirement changes in a mirrored system configuration (col. 3, line 45-col. 4, line 59; fig. 9 and related text).

**2. Claims 2 and 19**

Appellant's arguments with respect to claims 2 and 19 parallel Appellant's arguments with respect to claim 1 presented above, and are therefore addressed in the manner that claim 1 has been addressed above.

**3. Claim 20**

Appellant's arguments with respect to claim 20 parallel Appellant's arguments with respect to claim 1 presented above, and are therefore addressed in the manner that claim 1 has been addressed above.

**4. Claims 21 and 22**

Appellant's arguments with respect to claim 21 and 22 parallel Appellant's arguments with respect to claims 1 and 20 presented above, and are therefore addressed in the manner that claims 1 and 20 have been addressed above.

**5. Claim 23**

Appellant's arguments with respect to claim 23 parallel Appellant's arguments with respect to claim 1 presented above, and are therefore addressed in the manner that claim 1 has been addressed above.

In addition, Appellant argues "the Examiner chose to ignore elements and limitations of the claim... the Examiner gave no rationale why the various elements and limitations were ignored... Applicant intended these elements and limitations to have limiting effect… Applicant intended these elements and limitations to have limiting effect; after all, they also appeared, in a different form in other claims".

In response, these arguments have been fully considered, but they are not deemed persuasive.

First, the Examiner respectfully submits that limitations in claim 23 have not been ignored in the rejection of claim 23 in the final office (Refer to Final office mailed on 5/21/2010); however, as Appellant's own arguments have recognized, the limitations in claim 23 "appeared, in a different form in other claims", and are claimed in a different form in claim 23 from other claims. The limitations in claim 23 have not simply been ignored by the Examiner since they have been interpreted according to how they have been claimed. For example, the claim language "adapted to", "for", "to" appearing in claim 23, suggests that the functional language modified by this claim language refers to the intended use of the claimed structures. A recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. Refer to MPEP 2114 II (C).

**6. Claims 24 and 9**

Appellant's arguments with respect to claims 24 and 9 parallel the rest of Appellant's arguments, and are therefore addressed in the manner that the rest of the arguments have been addressed above.

**B. 103(a): Obviousness over Lubbers in view of Bridge and Cabrera (Claims 3, 17 and 18)**

Appellant's arguments with respect to claims 3, 17 and 18 parallel Appellant's arguments with respect to claim 1 presented above, and are therefore addressed in the manner that claim 1 has been addressed above.

**1. Dependent Claim 17**

With respect to the limitation "providing by the source virtual disk continuous availability for normal disk access operations between the step of receiving a request and the step of reporting the new storage size of the source virtual disk", Appellant argues Lubbers' disclosure is irrelevant to claim 17 because "Figure 6 of Lubbers, to which the cited language refers, pertains to creation of a new destination virtual disk... and not to resizing of a mirrored pair or set; and... includes quiescing the source virtual disk… and copying data in background... this is anything but "continuous availability"… Cabrera… is referenced as disclosing "logical volumes and their plex are dynamically mapped and resized under the control of the operating system

without system disruption"... Cabrera does not disclose the relative timing or resizing and reporting in a mirrored pair required by claim 1."

In response, these arguments have been fully considered but are not deemed persuasive since Cabrera has not been relied upon for disclosing "the relative timing or resizing and reporting in a mirrored pair" but the combination of Lubbers and Bridge has been relied upon for disclosing these limitations. See discussion above regarding arguments with respect to claim 1.

The combination of Lubbers, Bridge and Cabrera discloses "providing by the source virtual disk continuous availability for normal disk access operations between the step of receiving a request and the step of reporting the new storage size of the source virtual disk"; as **[Lubbers discloses the host can continuously write to source (col. 12, line 38-col. 13, line 15)]**; but Lubbers is not explicitly that this continuous access occurs during resizing. However, Cabrera discloses **[logical volumes and their plex are dynamically mapped and resized under the control of the operating system without system disruption (col. 8, lines 59-67; col. 10, lines 4-17; col. 11, line 50-col. 12, line 33)]**; thus, disclosing resizing (which would include between the step of receiving a request and the step of reporting the new storage size of the source virtual disk) of logical volume mirror pairs while providing continuous access or no disruption. Therefore, it would have been obvious to one of ordinary skill in the art to modify the combined system of Lubbers and Bridge to have logical volumes and their plex are dynamically mapped and resized under the control of the operating system without system disruption as taught by Cabrera discloses since this would provide faster and continuous access while configuring/reconfiguring logical volumes.

**2. Dependent Claim 18**

Appellant's arguments with respect to claim 18 parallel Appellant's arguments with respect to claim 1 presented above, and are therefore addressed in the manner that claim 1 has been addressed above.

Further, Appellant argues "The portions of Lubbers and Cabrera cited by the Examiner as teaching continuous mirroring do not pertain to a resizing operation".

**C. 112: failure to comply with a written description requirement (Claim 16)**

Appellant's arguments with respect to the 35 US 112, first paragraph rejection of claim 16 are deemed persuasive; therefore, the rejection under 35 US 112, first paragraph of claim 16 has been withdrawn.

**D. 103(a): obviousness over Lubbers in view of Bridge and DeKoning (Claim 16)**

Appellant argues "Lubbers does not specify the order for reporting a reduction in the size of the copy (mirrored) set. Bridge deals with shrinking a single logical volume, and so does not provide this critical missing piece."

In response, these arguments have been fully considered, but they are not deemed persuasive.

In view of the following discussion, Examiner would like to emphasize the following:

Sources of rationale supporting a rejection under 35 U.S.C. 103 may be in a reference, or reasoned from common knowledge in the art, scientific principles, art recognized equivalents, or

legal precedent. The CCPA has held that "in considering the disclosure of a reference, it is proper to take into account not only specific teachings of the reference but also the inferences which one skilled in the art would reasonably be expected to draw therefrom." In re Preda, 401 F.2d 825, 826, 159 USPQ 342, 344 (CCPA 1968); MPEP 2144.01.

In determining obviousness under 35 U.S.C. 103 in view of the Supreme Court decision in KSR International Co. v. Teleflex Inc., the Supreme Court stated that: "If a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill".

Still further, the Court states that "the focus when making a determination of obviousness should be on what a person of ordinary skill in the pertinent art would have known at the time of the invention…and this is regardless of whether the source of that knowledge and ability was documentary prior art, general knowledge in the art, or common sense".

Appellant should note that the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See In re Keller, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

Appellant's arguments stating that Bridge's disclosure does not apply to the pending claims because Bridge deals with shrinking a single logical volume are not deemed persuasive since the Examiner respectfully submits that Bridge's disclosure has been relied upon for teaching and suggesting when to report the new size when shrinking storage capacity. Appellant

should note that a RAID comprises a mere logical volume which is configured as a mirrored configuration; thus Bridges's teachings regarding when to report the sizes of logical volumes when shrinking them, which, according to Bridge may be mirrored, are deemed to make obvious modifications regarding when to report the sizes of the copy sets taught by Lubbers. More specifically, from Bridge's disclosure which teaches shrinking logical volumes and **[when the logical volume shrunk, the size of the logical volume is first updated in the volume directory (thus made available), then each extent set is deallocated until the logical volume has shrunk to the correct size (col. 20, lines 1-33; also refer to expanding in col. 16, line 32-col. 17, line 4) wherein the added or removed extents may be mirrored (col. 17, line 5-col. 18, line 58)]**, one of ordinary skill in the art would conclude that it would be obvious to modify the system/method taught by Lubbers where a copy set may be shrunk to first resize and providing the resized copy for operation and then manipulate the physical storage associated with the copy set, since Bridge discloses doing so would provide the advantage of dynamically accommodating to system requirement changes in a mirrored system configuration (col. 3, line 45-col. 4, line 59; fig. 9 and related text), and would further allow the system/method of Lubbers to only provide the new shrunk size available for operation before actually performing the manipulation of the copy set, thus preventing usage of portions of the copy set that will not be present once the copy set is shrunk, and speeding the process of shrinking a copy set or RAID volume.

More specifically, the combination of Lubbers, Bridge and DeKoning discloses "before the step of manipulating the RAID, resizing the mirrored virtual disks, and providing the resized mirrored virtual disks for operation" as Lubbers discloses changing the reported size of the

virtual disks and making the virtual disks available for operation; **[Lubbers discloses resizing virtual disks or logical units (LUNs) in an automated fashion in a copy set or replication environment having source and destination LUNs wherein each LUN has a RAID 0-5 data protection (col. 4, lines 44-67; col. 5, lines 59-62), and explains "hosts… access physical storage capacity by addressing read and write operations to specified LUNs… storage controller… manage the tasks of allocating… resizing LUNs, and other functions that maintain integrity and availability of the data" (col. 5, line 51-col. 6, line 5); thus, the reported size of the virtual disks is changed and the disks are available to hosts as LUNs]**; note that there is no specific order associated with this portion of the limitation. Lubbers does not expressly disclose "before the step of manipulating the RAID, resizing the mirrored virtual disks, and providing the resized mirrored virtual disks for operation".

Bridge discloses changing the reported size of the virtual disks and making the virtual disk available for operation; as **[shrinking logical volumes by removing extents and updating directory (col. 20, lines 1-33)]** and after making the virtual disks available for operation, manipulating physical storage in order to resize the virtual disks by deallocating necessary storage in order to reach the desired shrunk size **[wherein when the logical volume shrunk, the size of the logical volume is first updated in the volume directory (thus made available), then each extent set is deallocated until the logical volume has shrunk to the correct size (col. 20, lines 1-33; also refer to expanding in col. 16, line 32- col. 17, line 4) wherein the added or removed extents may be mirrored (col. 17, line 5-col. 18, line 58)]**.

At the time of the invention it would have been obvious to modify the resizing of Lubbers to specifically, after resizing and making the virtual disks available for operation, manipulating

physical storage in order to resize the virtual disks by deallocating necessary storage in order to reach the desired shrunk size as taught by Bridge, since Bridge discloses doing so would provide the advantage of dynamically accommodating to system requirement changes in a mirrored system configuration (col. 3, line 45-col. 4, line 59; fig. 9 and related text).

**(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Yaima Campos

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